



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

small particle of a crystal of the substance is dropped into the solution, and a crystal at once begins to grow about this as a center, just as the feathers accumulated about the tangled hair as a center. How very minute, though, must be the meshes to entrap the first molecule!

Another analogous aggregation is the condensation of moisture about dust particles in the atmosphere, thus starting the formation of the fog or cloud vesicles from which grow the raindrops. By the same principle a thin film of moisture is collected on every surface, no matter how dry apparently it may be; and each surface has its own entrapping power, from that of a quartz crystal where the film is inconceivably small, to the hygroscopic surface of a calcium chloride crystal where the accumulation of water is so rapid as to become visible in a few seconds.

Now, may we not go a step further and look for an analogous structure in the molecule? The theory of the molecule is that it is an aggregate of atoms suspended in an agitated medium—the ether. By the vibrations continually running through the ether the atoms are crowded to centers, thus constituting molecules. The nature of the molecule will depend upon the size, form, and weight of the atoms. These are fixed qualities of the atom; hence the resultant molecules are always the same. The apparent exceptions in the case of the allotropic forms of carbon, sulphur, and phosphorus may be explained by several arrangements being possible, though some particular one is more likely than another, as in the case of pyrite, which commonly occurs in cubes though sometimes in octahedral and dodecahedral forms. By such an hypothesis we have an explanation of chemical affinity. Chemical affinity under this view is a driving of such atoms together which most perfectly fit together in the molecule. Should another set of atoms as a reagent be introduced, they may be so constituted as to fit more perfectly with the present set than these do among themselves, and at once a reaction takes place, with a new arrangement as a result. Possibly the tendency toward rearrangement is too feeble to produce any result under the ordinary disturbances of the ether, and some special vibrations must be introduced, as when chlorine is helped to decompose water in sunlight. Here we may also find an explanation for chemical energy, by accounting for it as residing in the ether movement which binds the fitting atoms together into the symmetrical molecule. We can also account for the heat which results from chemical reaction by regarding it as the energy of the motion of the atoms as they come together being transformed into the energy of agitation of the new molecules, which is heat.

When the darkeys find feather balls in their pillows they believe that they have been hoodooed, and they find in the “pillow-witches” an explanation of all their ills and misfortunes. Why should not the chemist find in them also a solution to many of his perplexities.

VARIATIONS IN THE NITROGEN-CONTENT OF MAIZE, AND POSSIBILITIES FOR IMPROVEMENT OF IT.

BY J. T. WILLARD, MANHATTAN.

Read before the Academy December 30, 1898.

That plants vary, and that it is because of this variation that improvement is possible, is a fact known to every student of science. That chemical differences should be present in individuals which present no external differences could not be assumed, and by many would not be suspected. Twelve years ago the author

presented to this Academy the evidence that individual stalks of sorghum vary greatly in their sugar-content, even when of the same variety and general development. That fact followed up by the Kansas Experiment Station and the United States Department of Agriculture resulted in the improvement of several varieties of sorghum, by selection of individual stalks by chemical analysis of the juice, to the extent of several per cents. That similar results may be obtained with corn seems not unreasonable. With corn, however, the desire is to increase the percentage of proteids in the grain. Corn is king, no doubt, now, but we desire to make him more worthy still of his regal position. Corn is rich in carbohydrates and fat, but too deficient in proteids to make it an ideal feed for any purpose. Its best utilization requires that its excess of carbonaceous constituents be balanced by the addition of feeds rich in nitrogen; hence the dairyman adds wheat bran, gluten meal, oil-cake, or some other feed rich in proteids. For growth, for labor, and even for fattening, corn lacks nitrogen. The average percentage in corn is about ten; in wheat, twelve; in bran, sixteen; and in oil-meal, thirty-three. Could we increase the proteids of corn by two or three per cent., it would raise the value of the annual crop millions of dollars.

The compilation of analyses of corn published in Experiment Station Bulletin No. 11, office of experiment stations, shows that the average protein-content of dent corn is 11.5 per cent., calculated on the dry matter; the minimum is 8.2 per cent., and the maximum 13.8.

The results about to be given were obtained in analyses incident to a joint experiment now being carried on by the farm, botanical and chemical departments of the Experiment Station of the State Agricultural College, in which the object is to improve corn in its protein-content, by seed selection based on chemical analysis. Cross fertilization between the best varieties, it is hoped, will result in the establishment of a better one than any now known, and careful selection should lead to relative fixity of type.

As a preliminary, analyses were made of single ears from thirty-three varieties grown in this state, and collected as good ones. These showed a nitrogen-content of from 1.56 per cent. to 2.26, corresponding to 9.75 and 14.12 per cent. of proteids, respectively, calculated on the dry substance. These would not be fair figures by which to judge the varieties, as but a single ear was used for the sample, and it was found by another set of analyses that individual ears of the same variety varied to as great an extent.

To study the variation in different ears of the same variety, one was chosen which was the result of a crossing of white and yellow corn, and another which had been grown on the same farm by the same man for thirty years, without admixture of other seed. It was thought that the former would represent an unstable variety, and the latter a fixed type, if such could be formed by ordinary selection of seed. Ten individual ears of each were analyzed. The cross-bred corn showed a variation from 1.35 per cent. of nitrogen to 2.22; the other varied from 1.53 to 2.24. These great differences, even in the case of the supposed fixed type, show what wonderful possibilities in seed selection are open to us. If the average composition can be raised to that of the best ears, the grain will be equal to wheat in feeding value, if equally digestible. In sampling for these analyses a narrow belt of kernels was taken around the middle of the ear in each case.

We went still further, and took the ear from the fixed type which had shown the highest percentage of nitrogen, and made analyses of individual kernels from it. These were taken from the middle of the ear, and were selected to as nearly as practicable the same weight, since kernels of differing size might easily be supposed to have the several parts of the grain present in differing proportions.

Fifteen individual grains were analyzed, and their variation was from 1.72 per cent. to 2.30. These figures show that, to make selection most effective, we must be able to separate the desirable kernels from the less so, and not depend simply on selection of ears. Upon this problem we are still at work. It is evident that we cannot analyze our kernel, and plant it too, and that some physical test only is available. Our task is to find a usable physical property which varies with the per cent. of nitrogen. The specific gravity suggests itself as best adapted to our needs. Investigation of this point has not yet reached definite results. The differences in specific gravity are very slight, and since parallel determinations of the nitrogen in single kernels are impracticable, a large number of analyses will be necessary before a positive result can be expected. The determination of the specific gravity, while theoretically simple by means of a heavy solution and the Westphal balance, presents considerable difficulty because of the adherence of air to the grain with great tenacity, and because of the occurrence of cavities within the kernels sometimes.

Analysis of the several parts of the grain has shown that the germ is much the richest in nitrogen. Constituting about ten per cent. of the weight, it contains sixteen per cent. of the nitrogen. It also contains sixty-five per cent. of the oil. An increase in the size of the germ, therefore, will insure an increase in the percentage of the most valuable parts. Differences in the size of the germ are easily seen by simple sections through the kernels with a sharp pocket-knife, and ears can be selected showing a predominance of large germs.

WATER PURIFICATION.

BY W. TWEEDDALE, TOPEKA.

Read before the Academy December 30, 1898.

The character of the water-supply of a country is the determining element of its potential future, as regards its being the habitation of man, whether it be by the solitary pioneer or a community of individuals, as in ranch, village, town, or city like New York, with a population of millions.

Modern sanitation requires that not only shall the quantity be abundant, but that the quality shall be suited to the uses to which it is to be applied. Medical science forbids that the cholera-infected water in the sacred tanks of India be longer used for dietetic purposes; and in the same line demands that, if water for potable purposes cannot be procured, provision be made to render it so by some system of purification. The necessity for this purification is due to the very solvent power of water acting on solid substances, such as clay, the presence of which in a state of suspension causes turbidity, together with the solvent power of gases in water acting chemically on inorganic earth salts, causing the property termed hardness and the fermentation (putrefactive decomposition) of organic substances, the presence of which in this state constitutes the nidus for the development of bacteria.

In this country the purification of public water-supplies has been mainly restricted to the removal of visible impurities in suspension, including bacteria. This is sought to be done by filtration or by subsidence. There are two systems of filtration: 1st, sand filters, English system, as it is termed, with or without being allowed to deposit the coarser particles by sedimentation; and, 2d, the mechanical filters, American system, combined with the use of a coagulant.

Subsidence is the practice in cities whose sources of supply are the waters ob-